WHAT ARE CLAIMED ARE:

1. A solid-state image pickup device, comprising:

a semiconductor substrate having a two-dimensional plane on a surface thereof;

photoelectric converter elements arranged in a matrix configuration having rows and columns, and formed in said two-dimensional plane;

one vertical charge transfer channel region formed in said semiconductor substrate for each of the columns of said photoelectric converter elements, adjacent to said each column;

two charge transfer electrodes so disposed over said vertical charge transfer channel regions for each of the rows of said photoelectric converter elements as to intersect said vertical charge transfer channel regions;

an array of color filters each of which is formed for each of said photoelectric converter elements over said each photoelectric converter element, said array including color layouts each of which includes n rows of said color filters; and

a drive circuit for conducting a readout operation in which (m*n) rows of photoelectric converter elements are classified as one set, a plurality of units of photoelectric converter element rows which are symmetrically distributed are respectively selected from said sets of photoelectric converter element rows, and electric charge is read from said plural units of photoelectric converter element rows to be fed to said vertical charge transfer channel regions,

said readout operation comprising:

a first readout operation for reading electric charge from a first group of photoelectric converter element rows which have an asymmetric distribution, into said vertical charge transfer channel regions;

a j-row transfer operation for transferring the electric charge for j rows after said first readout operation; and

a second readout operation for reading electric charge from a second group of photoelectric converter element rows which have an asymmetric distribution at positions to which the electric charge is transferred by said j-row transfer operation, into said vertical charge transfer channel regions, and for adding the electric charges to each other in said vertical charge transfer channel regions,

said first and second readout operations reading electric charge from two rows included in one unit of photoelectric converter element rows.

2. The solid-state image pickup device according to claim 1, wherein:

said n is two;

said m is four; and

said selected units selected by said readout operation are two units per said set.

3. The solid-state image pickup device according to claim 2, wherein:

said selected units are obtained from every second unit;

said first readout operation is conducted for a second row of a first selected first unit and for a first row of a second selected unit; and

said second readout operation is conducted for a first row of said first selected first unit and for a second row of said second selected unit.

4. The solid-state image pickup device according to claim 1, wherein:

said n is three;

said m is six;

said selected units are three units per said set;

said drive circuit is capable of conducting after said second readout operation:

a j-row transfer operation for transferring the electric charge for j rows; and

a third readout operation for reading electric charge from a third group of photoelectric converter element rows which have an asymmetric distribution at positions to which the electric charge is transferred by said j-row transfer operation, into said vertical charge transfer channel regions, and for adding the electric charge to each other in said vertical charge transfer channel regions.

5. The solid-state image pickup device according to claim 4, wherein:

said selected units are obtained from every second unit;

said first readout operation is conducted for mutually different rows of selected first, second, and third units; and

said first, second, and third readout operations read electric charge from a first row, a second row, and a third row of said selected first, second, and third units, respectively.

6. A method of controlling a solid-state image pickup device comprising a semiconductor substrate having a two-dimensional plane on a surface thereof, photoelectric converter elements arranged in a matrix configuration having rows and columns, and formed in said two-dimensional plane, one vertical charge transfer channel region formed in said semiconductor substrate for each of the columns of said photoelectric converter elements, adjacent to said each column, two charge transfer electrodes so disposed over said vertical charge transfer channel regions for each of the rows of said photoelectric converter elements as to intersect said vertical charge transfer channel regions, and an array of color filters each of which is formed for each of said photoelectric converter elements over said each photoelectric converter element, said array including color layouts each of which includes n rows of said color filters, said method comprising the steps of;

(a) classifying (m*n) rows of photoelectric converter elements as one set, selecting a plurality of units of photoelectric converter element rows, which are symmetrically distributed, respectively from said sets of photoelectric converter element rows, reading electric charge from a first group of photoelectric converter element rows which have an asymmetric distribution in said unit thus selected and feeding the electric charge into said vertical charge transfer channel regions;

(b) transferring the electric charge for j rows after said readout step (a); and

(c) reading electric charge from a second group of photoelectric converter element rows which have an asymmetric distribution at positions to which the electric charge is transferred by said transfer step (b), feeding the electric charge to said vertical charge transfer channel regions, and adding the electric charges to each other in said vertical charge transfer channel regions,

said first and second readout steps (a) and (c) reading electric charge from two rows contained in one unit of photoelectric converter element rows.

7. The method of controlling a solid-state image pickup device according to claim 6, wherein:

said n is two;

said m is four; and

said selected units selected by said readout step (a) are two units per said set.

8. The method of controlling a solid-state image pickup device according to claim 7, wherein:

said selected units are obtained from every second unit;

said readout step (a) is conducted for a second row of a first selected first unit and for a first row of a second selected unit; and

said readout step (c) is conducted for a first row of said first selected first unit and for a second row of said second selected unit.

9. The method of controlling a solid-state image pickup device according to claim 6, wherein:

said n is three;

said m is six; and

said selected units are three units per said set, said method further comprising the steps of;

(d) transferring the electric charge for j rows after said second readout step (c); and

(e) reading electric charge from a third group of photoelectric converter element rows which have an asymmetric distribution at positions to which the electric charge is transferred by said j-row transfer step (d), feeding the electric charge to said vertical charge transfer channel regions, and adding the electric charge to each other in said vertical charge transfer channel regions.

10. The method of controlling a solid-state image pickup device according to claim 9, wherein:

said selected units are obtained from every second unit;

said readout step (a) is conducted for mutually different rows of selected first, second, and third units; and

said steps (a), (c), and (e) read electric charge from a first row, a second row, and a third row of said selected first, second, and third units, respectively.

11. A solid-state image pickup device, comprising:

a semiconductor substrate having a two-dimensional plane on a surface thereof;

a plurality of photoelectric converter elements arranged in the two-dimensional plane in a matrix configuration having rows and columns;

an array of color filters including one color layout of two rows as one unit, said unit being repeatedly arranged in said array in a column direction, in which one color filter thereof is formed over each of said photoelectric converter elements, said two rows including a row of a first color layout of color filters arranged in a row direction and a row of a second color layout of color filters arranged in a row direction, said second color layout being different from said first color layout;

one vertical charge transfer channel region formed in said semiconductor substrate for each of the columns of said photoelectric converter elements, adjacent to said each column;

a plurality of vertical charge transfer electrodes in which two vertical charge transfer electrodes are disposed over said vertical charge transfer channel regions for each of the rows of said photoelectric converter elements; and

a drive circuit capable of applying readout pulse voltages to

said vertical charge transfer electrodes corresponding to said photoelectric converter element row having said first color layout in a first photoelectric converter element row pair of two photoelectric converter element rows adjacent to each other in a column direction and to

said vertical charge transfer electrodes corresponding to said photoelectric converter element row having said second color layout in a second photoelectric converter element row pair of two photoelectric converter element rows adjacent to each other in a column direction, said second photoelectric converter element row

pair being at a position apart from said first photoelectric converter element row pair by two photoelectric converter element rows in the column direction.

12. The solid-state image pickup device according to claim 11, further comprising a variable barrier formed in said semiconductor substrate below said photoelectric converter elements,

said variable barrier being capable of modulating an amount of electric charge accumulable in each of said photoelectric converter elements.

13. A solid-state image pickup device, comprising:

a semiconductor substrate having a two-dimensional plane on a surface thereof;

a plurality of photoelectric converter elements arranged in the two-dimensional plane in a matrix configuration having rows and columns;

an array of color filters including one color layout of n rows as one unit, said unit being repeatedly arranged in a row direction in said array, said n rows ranging from a first row to an n-th row respectively having mutually different color layouts in the row direction in which one color filter of said array is formed over each of said photoelectric converter elements;

one vertical charge transfer channel region formed in said semiconductor substrate for each of the columns of said photoelectric converter elements, adjacent to said each column;

a plurality of vertical charge transfer electrodes in which two vertical charge transfer electrodes are disposed over said vertical

charge transfer channel regions for each of the rows of said photoelectric converter elements; and

a drive circuit capable of independently applying readout pulse voltages to

said vertical charge transfer electrodes included in said photoelectric converter element rows having mutually different color layouts between said photoelectric converter element row units, said photoelectric converter element rows being included in a set of n rows including

a first photoelectric converter element row having said first color layout, said first row being selected from said first photoelectric converter element row unit including n rows succeeding one after another in a column direction and

second to n-th photoelectric converter element rows sequentially formed at positions beginning at a position apart from said first photoelectric converter element row unit by (2 X n) photoelectric converter element rows in the column direction.

14. The solid-state image pickup device according to claim 13, further comprising a variable barrier formed in said semiconductor substrate below said photoelectric converter elements,

said variable barrier being capable of modulating an amount of electric charge accumulable in each of said photoelectric converter elements to n times an original amount thereof.

15. A method of controlling a solid-state image pickup device, comprising a semiconductor substrate having a two-dimensional plane on a surface thereof; a plurality of photoelectric converter

elements arranged in the two-dimensional plane in a matrix configuration having rows and columns; an array of color filters including one color layout of two rows as one unit, said unit being repeatedly arranged in said array in a column direction, said two rows including a row of a first color layout of color filters arranged in a row direction in which one color filter thereof is formed over each of said photoelectric converter elements and a row of a second color layout of color filters arranged in a row direction, said second color layout being different from said first color layout; one vertical charge transfer channel region formed in said semiconductor substrate for each of the columns of said photoelectric converter elements, adjacent to said each column; a plurality of vertical charge transfer electrodes in which two vertical charge transfer electrodes are disposed over said vertical charge transfer channel regions for each of the rows of said photoelectric converter elements; and a drive circuit capable of applying readout pulse voltages to said vertical charge transfer electrodes corresponding to said photoelectric converter element row having said first color layout in a first photoelectric converter element row pair of two photoelectric converter element rows succeeding one after another in a column direction and to said vertical charge transfer electrodes corresponding to said photoelectric converter element row having said second color layout in a second photoelectric converter element row pair of two photoelectric converter element rows contiguous to each other in a column direction, said second photoelectric converter element row pair being at a position apart

from said first photoelectric converter element row pair by two photoelectric converter element rows in the column direction, said method comprising the steps of:

a) classifying said vertical charge transfer electrodes into sets each of which includes 16 vertical charge transfer electrodes as one set, said 16 vertical charge transfer electrodes ranging from a first vertical charge transfer electrode to a 16th vertical charge transfer electrode succeeding one after another, and

applying readout pulse voltages to

said vertical charge transfer electrodes belonging to said photoelectric converter element row having said first color layout of said first photoelectric converter element row pair including two rows adjacent to each other in the column direction, said first row pair being selected from each said set and to

said vertical charge transfer electrodes belonging to said photoelectric converter element row having said second color layout different from said first color layout of said second photoelectric converter element row pair including two rows adjacent to each other in the column direction, said row pair being formed in positions beginning at a position apart from said first photoelectric converter element row pair by four photoelectric converter element rows in the column direction;

b) transferring the signal charge read out by said step a) through said vertical charge transfer channel regions for four photoelectric converter element rows in column direction;

c) applying readout pulse voltages to said vertical charge transfer electrodes belonging to said photoelectric converter element rows of said first and second photoelectric converter element row pairs, said photoelectric converter element rows being not used to read the electric charge therefrom in said step a); and

d) transferring the electric charge read out in said step c) and the electric charge read out in said step a) in said vertical charge transfer channel regions.

16. The method of controlling a solid-state image pickup device according to claim 15, wherein said device further comprises a variable barrier formed in said semiconductor substrate, said variable barrier being capable of modulating an amount of electric charge accumulable in each of said photoelectric converter elements, said method further comprising the step of

x) modulating by said variable barrier an amount of electric charge accumulable in each of said photoelectric converter elements to one half of an original amount thereof before said step a).

17. A method of controlling a solid-state image pickup device, comprising a semiconductor substrate having a two-dimensional plane on a surface thereof; a plurality of photoelectric converter elements arranged in the two-dimensional plane in a matrix configuration having rows and columns; an array of color filters including one color layout of n rows as one unit, said unit being repeatedly arranged in a row direction in said array, said n rows

ranging from a first row to an n-th row respectively having mutually different color layouts in the row direction in which one color filter of said array is formed over each of said photoelectric converter elements; one vertical charge transfer channel region formed in said semiconductor substrate for each of the columns of said photoelectric converter elements, adjacent to said each column; a plurality of vertical charge transfer electrodes in which two vertical charge transfer electrodes are disposed over said vertical charge transfer channel regions for each of the rows of said photoelectric converter elements; and a drive circuit capable of independently applying readout pulse voltages to said vertical charge transfer electrodes included in said photoelectric converter element rows having mutually different color layouts in said photoelectric converter element row units, said photoelectric converter element rows being included in a set of n rows including

a first photoelectric converter element row having said first color layout, said first row being selected from said first photoelectric converter element row unit including n rows succeeding one after another in a column direction and

second to n-th photoelectric converter element rows sequentially formed at positions beginning at a position apart from said first photoelectric converter element row unit by (2 X n) photoelectric converter element rows in the column direction, said method comprising the steps of:

a) classifying said vertical charge transfer electrodes into sets each of which includes (4 X n) vertical charge transfer electrodes as one set, and

independently applying readout pulse voltages to said vertical charge transfer electrodes included in said photoelectric converter element rows having mutually different color layouts in said photoelectric converter element row units, said photoelectric converter element rows being included in a set of n rows including

a first photoelectric converter element row having said first color layout, and second to n-th photoelectric converter element rows at positions beginning at a position apart from said first photoelectric converter element row unit by (2 X n) photoelectric converter element rows in the column direction and at a same pitch;

b) transferring signal charge read out by said step a) through said vertical charge transfer channel regions for (2 X n) photoelectric converter element rows in column direction; and

c) conducting a readout operation and a transfer operation for said vertical charge transfer electrodes belonging to said photoelectric converter element rows of said photoelectric converter element row unit including said first to n-th photoelectric converter element row pairs, said photoelectric converter element rows being not used to read the electric charge therefrom in said step a).

18. The method of controlling a solid-state image pickup device according to claim 17, wherein said device further comprises a variable barrier formed in said semiconductor substrate, said variable barrier being capable of modulating an amount of electric

charge accumulable in each of said photoelectric converter elements, said method further comprising the step of

x) controlling said variable barrier to modulate an amount of electric charge accumulable in each of said photoelectric converter elements to 1/n of an original amount thereof before said step a).